Abh. Verh. naturwiss. Ver. Hamburg | (NF) 21/22 | 135–147 | Hamburg 1978

The Distribution of Millipedes in the South of England – A Preliminary Survey

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Abstract: Millipedes were collected in Southern England from 1967 to 1974, and records were kept of their distribution. These records were charted using National Grid references; data were also recorded concerning the nature of the habitats in which the animals were found. An area with representative soil and vegetation types was selected for particular attention. A summary of the results is given. The status and distribution of individual species is discussed. It is suggested that *Macrosternodesmus palicola* BRÖLEMANN is calcicolous. Some general observations about habitats and millipede distribution are made.

A. Introduction

In 1967, when this study began, there were few records concerning the distribution of millipedes in much of Southern England, and a high proportion of these were from the extreme SE and the extreme SW. The author began to investigate the occurrence of millipedes in the County of Surrey, and subsequently extended the area to include much of West Sussex and the eastern part of Hampshire, involving an area of about 3500 square kilometres in Central Southern England. Fig. 1 shows the southern counties and the study area. The area contains an interesting diversity of soils and vegetation, and it was hoped that it would give a representative view of millipede distribution, and show differences attributable to particular soil or vegetation types. However, all the other counties in the South were visited, and collections were made on a smaller scale, so that some account might be made of any differences of a regional nature that might emerge. The County of Kent was also investigated in detail by BARBER and KIME (Chilopoda and Diplopoda of Kent - in press).

Considerable use was also made of the up-to-date records of British millipede distribution kindly supplied by BLOWER (1972, 1974).

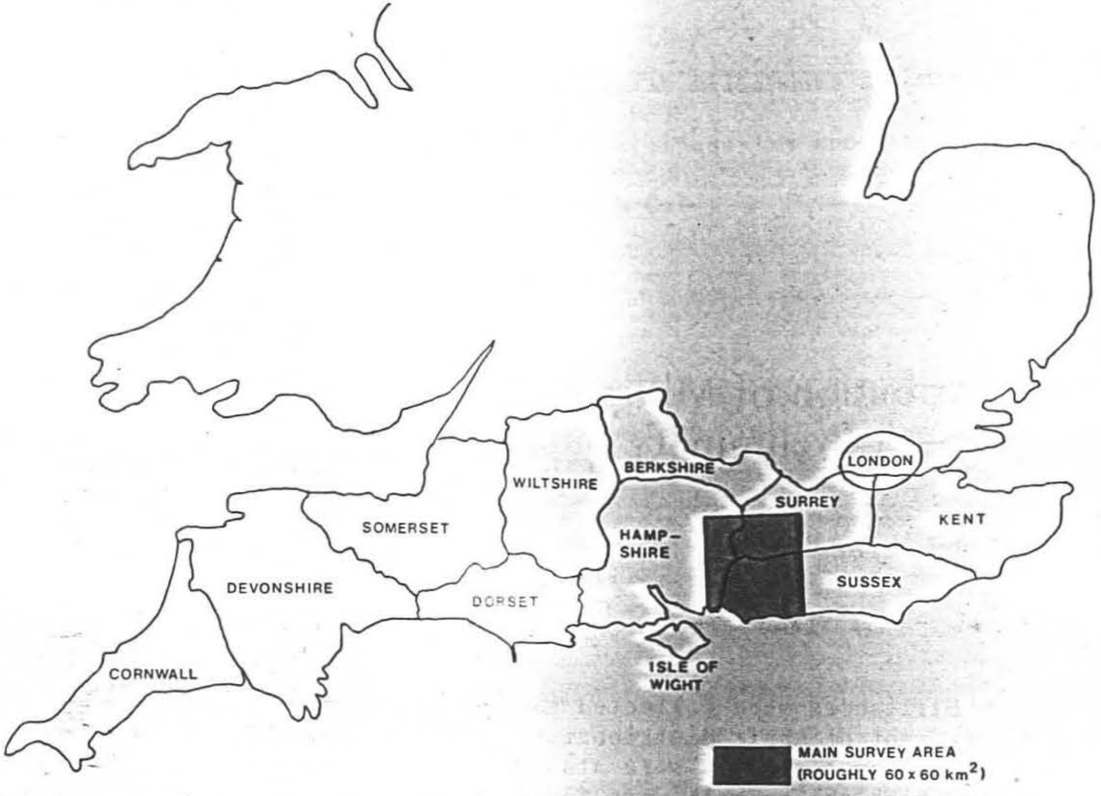

Fig. 1: The counties of Southern England.

B. Methods

Millipedes were collected and records were made on a one-kilometre square basis, using the National Grid; ten-kilometre squares were also used in charting the results, since National records are kept on this basis. At the same time, the habitat particulars of each collecting site were noted down, so that it would be possible to compile lists of millipedes from particular habitats, and to compare these with lists from different habitats in the same area, or with lists from similar habitats elsewhere. Particular attention was paid to the Western Weald in the study area, because extensive field work was possible on very different soils in a small geographical area, much of it is easily accessible, and it was conveniently near at hand.

In a survey on this scale, it follows that many sites were visited once only, although chosen sites were examined carefully at different times of the year, and in different years. Usually a visit entailed an examination below surface debris, in leaf litter, below the bark of fallen timber, and sometimes in the soil. Many species must have been overlooked in many of the habitats, and probably the results are biased in favour of aggregated surface-active species, but it is hoped, with the large amount of collecting that was done, the number of times an animal was found is to some extent correlated with abundance.

C. Results

Table 1 shows the overall results obtained from collecting millipedes in the main study area. The species are not necessarily ranked in order of abundance, but according to the number of dif-

Tab. 1: Frequency of millipedes in part of Central Southern England.

Species	Frequency order in survey area	Frequency order in England (BLOWER)	Number of km.squares in which found, and % of possible			
			Surrey	Sussex	Hampshire	Total
C. punctatus	1	2	78 (57 %)	28 (70 %)	13 (62 %)	119 (60 %)
P. angustus	2	1	64 (47 %)	19 (48 %)	6 (29 %)	89 (45 %)
G. marginata	3	5	54 (39 %)	23 (58 %)	10 (48 %)	87 (44 %)
T. niger	4	3	47 (34 &)	14 (35 %)	9 (43 %)	70 (35 %)
P. fuscus	5	8	31 (23 %)	12 (30 %)	10 (48 %)	53 (27 %)
B. superus	6	5	20 (15 %)	16 (40 %)	9 (43 %)	45 (23 %)
C. teutonicus	7	13	24 (18 %)	0	2 (10 %)	26 (13 %)
P. gallicus)	8	21	15 (11 %)	6 (15 %)	2 (10 %)	23 (12 %)
I. varicornis)		19	9 (7 %)	6 (15 %)	8 (38 %)	
P. polydesmoides	10	3	10 (7 %)	6 (15 %)	4 (19 %)	20 (10 %)
O. pilosus	11	9	11 (8 %)	6 (15 %)	0	17 (9 %)
C. proximus	12	36	8 (6 %)	6 (15 %)	1 (5 %)	15 (8 %)
C. britannicus	13	16	10 (7 %)	2 (5 %)	2 (10 %)	14 (7 %)
B. guttulatus	14	7	10 (7 %)	1 (3 %)	1 (5 %)	12 (6 %)
P. coriaceus)	15	12	7 (5 %)	1 (3 &)	0	8 (4 %)
P. denticulatus)		14	6 (4 %)	1 (3 %)	1 (5 %)	
M. scutellare)	17	21	3 (2 %)	0	4 (19 %)	7 (3.5%)
M. palicola)		24	1 (1 %)	4 (10 %)	2 (10 %)	
B. melanops)	19	34	3 (2 %)	1 (3 %)	0	4 (2 %)
B. pusillus)		15	1 (1 %)	1 (3 %)	2 (10 %)	
O. albonanus)	21	20	1 (1 %)	1 (3 %)	1 (5 %)	3 (1.5%)
A. pallidus)		23	1 (1 %)	0	2 (10 %	
C. rawlinsi)	23	27	2 (1 %)	0	0	2 (1 %)
E. italicum)		36	2 (1 %)	0	0	
O. sabulosus)		10	2 (1 %)	0	0	
I. scandinavius)		10	2 (1 %)	0	0	
P. lagurus	27	17	1 (1 %)	0	0	1 (0.5%)
M. gallicum		45	0	1 (3 %)	0	
B. tenuis		24	0	1 (3 %)	0	
C. nitidus		27	1 (1 %)	0	0	
C. latestriatus		17	1 (1 %)	0	0	
Number of species			29	21	19	31
Number of km.squares			137	40	21	198
Mean number spp. per square			3.1	3.9	4.2	3.4

ferent 1 km squares in which they were found. Separate results are shown for Surrey, West Sussex and Hampshire; some differences are discussed later. The frequency order of the species is compared with that for English species listed by BLOWER (1974). There is a general similarity, but certain species stand out as having a status in Central Southern England which is not typical of the Country as a whole. *Cylindroiulus teutonicus* (Pocock), *Polydesmus gallicus* LATZEL, *Isobates varicornis* (C.L. KOCH), *Chordeuma proximum* RIBAUT and *Brachychaeteuma melanops* BRADE-BIRKS occupy a much higher place on the list for Central Southern England, while *Polymicrodon polydesmoides* (LEACH), *Blaniulus guttulatus* (BOSC), *Ommatoiulus sabulosus* (LINNAEUS) and *Iulus scandinavius* LATZEL are placed much lower down. It can be said at once that the low position of *Blaniulus guttulatus* may well be attributed to the relatively small number of arable sites sampled and to the relative shortage of soil samples.

D. Discussion

Some of the species in Southern England seem to be restricted in distribution by more or less narrow ecological requirements, whereas others have either been found so infrequently or else from such a diversity of habitats that at the moment it is unwise to talk about limiting factors. Discussion of the status and distribution of individual species is confined to those whose status appears to be different in the study area compared with other parts of the country, or those where some new information allows some new hypotheses to be advanced.

The nematophorans are of particular interest in Southern England. *Polymicrodon polydesmoides* is very common locally, but there are not as many records as one would expect from its National distribution. Most of the recorded sites are calcareous, and it turns up frequently in escarpment beechwoods. But it also occurs in woods on clay and sandstone, and has been found in farmland, gardens, pastures, chalk pits and waste places. West of Hampshire it seems to be very common in woodland, though it is unrecorded for certain areas - for instance it was not found during the Field Meeting of the British Myriapod Group in North Devon in 1970. The general impression remains that it is far commoner in the West than in the East, and this would seem reasonable in view of its markedly western distribution in Europe, in areas influenced by the Gulf Stream Drift..

Craspedosoma rawlinsi LEACH is apparently very scarce in Southern England. There are two records from the survey area, both from Surrey woodland; one animal was found under a pine log and the other on bracken by A.D. BARBER. There are two records from Kent (BARBER & KIME, in press) and the only other record from the South up to the time of writing is one by COCKS from Falmouth in Cornwall in 1849 (TURK, 1944). One of the specimens from the South East was collected in January, two in February, and one in April. In view of its preference for cold, very moist habitats (HAACKER, 1968) it is to be expected that it should be much less common in the lowland south than in the north and west, a fact already stated by BLOWER (1974). The Surrey animals came from a range of sandstone hills about 300 m high with permanent springs at their base.

Brachychaeteuma melanops is now known from six counties in the extreme South (fig. 2). The Surrey and Sussex specimens were taken from chalk soils, or in one case from an area below the chalk downland in a garden and probably basic.

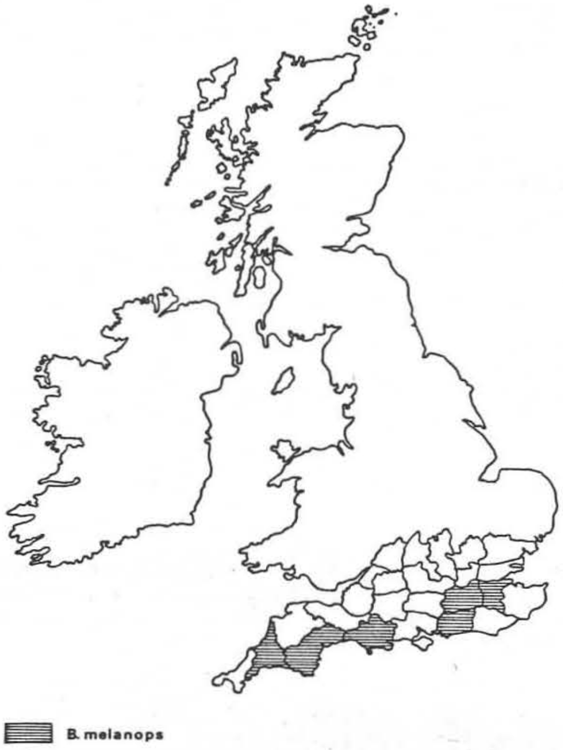

Fig. 2: Distribution of *Brachychaeteuma melanops* BRADE-BIRKS.

Chordeuma proximum has been found in 15 one-kilometre squares in the survey area, 13 of which were extentively covered by silver birch and/or oak and sometimes pine woodland on markedly acid Lower Greensand outcrops, frequently with bracken, (*Pteridium aquilinum* (LINNAEUS) KUHN), and sometimes with open areas of heather (*Calluna vulgaris* (LINNAEUS) HULL, *Erica tetralix* LINNAEUS, *E. cinera* LINNAEUS) as the field layer. A further habitat was a beech/chestnut wood on the same soil, and the animal was found to be common in a mixed deciduous - but mainly oak - wood on Gault clay just to the west of the sandstone belt. The adults were often plentiful between November and April, especially in 1968 and 1974, and most were found below logs or in deep leaf litter. This is another Atlantic species (fig. 3), which, unlike *P. polydesmoides*, appears at present to be confined to southern Britain. It favours warmer situations than *C. rawlinsi;* the only place in which both have been found is in the study area, and here not yet in the same one-kilometre square. Whilst the overlap in their ranges is likely to be much greater than shown in fig. 4, in the moment there is an interesting separation. A search in Kent has failed to reveal *C. proximum;* remarkably no chordeumoid has yet been found in Kent, though it is about the best worked British County.

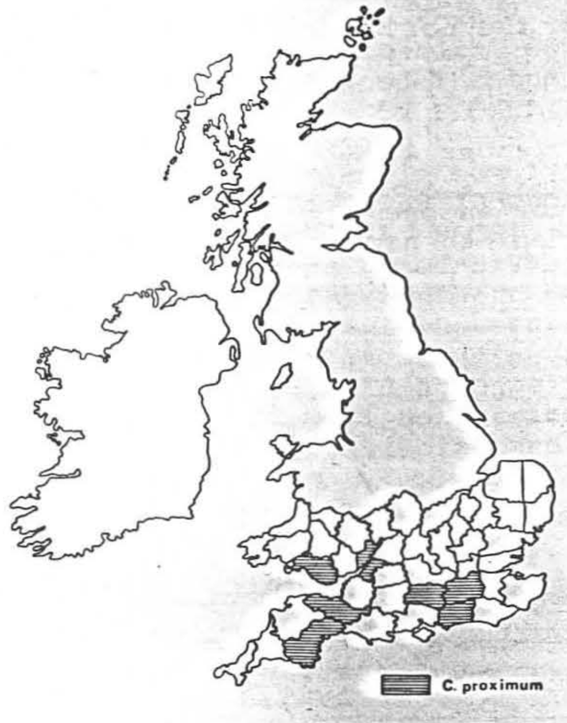

Fig. 3: Distribution of *Chordeuma proximum* RIBAUT in England and Wales.

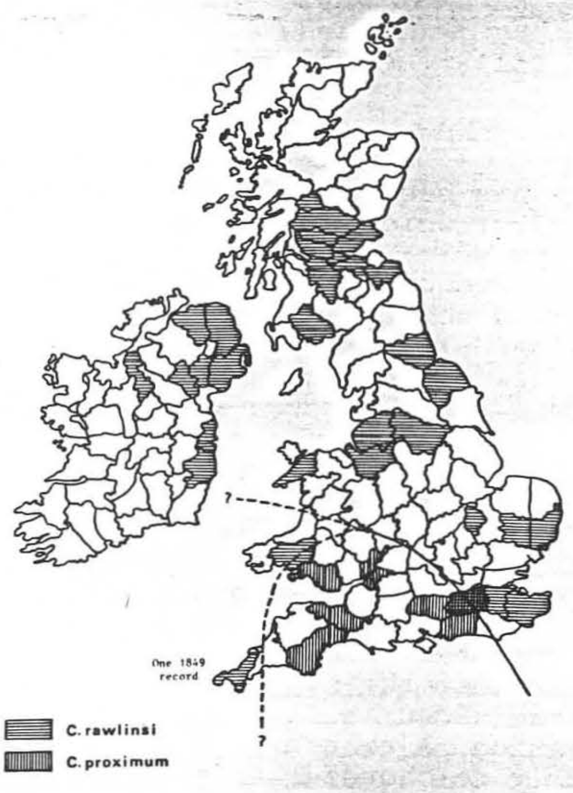

Fig. 4: *Chordeuma proximum* and *C. rawlinsi*: the overlap in their ranges.

Microchordeuma gallicum (LATZEL) may have a similar distribution to *C.proximum* in Britain (fig. 5), though it has been recorded fewer times, and only once in Central Southern England, as recently as 1974 in Sussex, together with *C. proximum* in a beech and holly wood on Lower Greensand. *Microchordeuma scutellare* (RIBAUT) extends further north and east and has been recorded much more often, including seven times in the present survey. At the same time, while *M. scutellare* extends further north in Britain than *M. gallicum*, *M. gallicum* apparently extends much further north-east on the Continent (fig. 6).

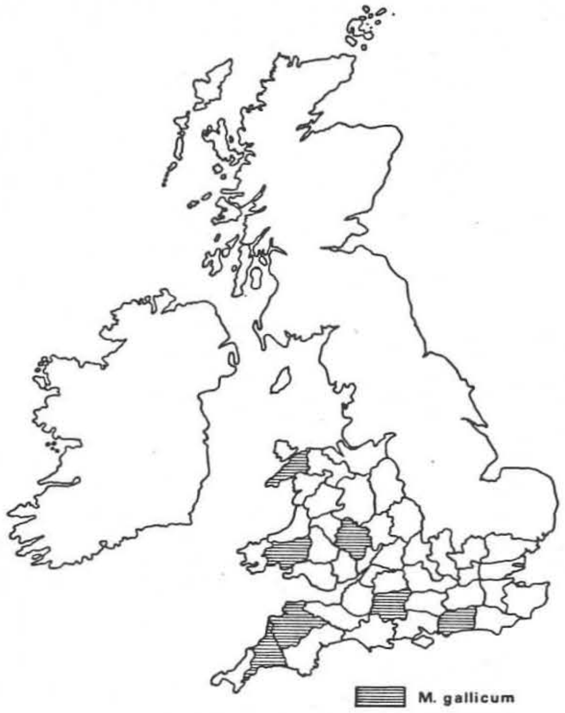

Fig. 5: Distribution of *Microchordeuma gallicum* (LATZEL) in England and Wales.

The collections of polydesmids made in the South have on the whole reflected their status in the British Isles given in BLOWER (1974), but much has come to light concerning three of them with restricted distributons.

Polydesmus gallicus is a common species in Central Southern England. It is a classic example of an Atlantic species (fig. 7). In the study area it has been almost entirely found on clay soils in damp situations, in three main habitats: oakwood on clay, damp pastures, and shaded escarpment woodlands, in that order of frequency. When found in pastures it has mostly been in association with *P. angustus* LATZEL, where large numbers of one or both species are aggregated under logs lying on the grass when such a situation arises. EASON (1958) recorded it from a number of parishes in the valleys of the Avon and the Stour on the Lower Lias in Warwickshire and Worcestershire. Most British records come from the West, and several from Ireland, where the rainfall and humidity are relatively high. Despite its abundance in the west of Surrey, there is only a single record from Kent, where an extensive search has been made (BARBER & KIME, in press). Its definite orientation towards the South and West of Britain suggests that it may be confined to the milder parts of the country, and fits in well with its range in the western half of France as far south as the Pyrenees (BRÖLEMANN, 1935).

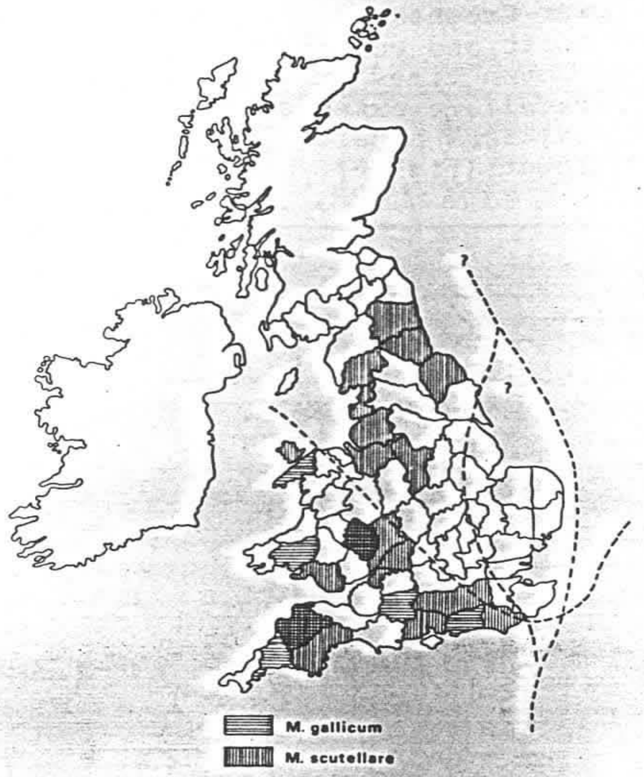

Fig. 6: *Microchordeuma gallicum* and *M. scutellare*: the overlap in their ranges.

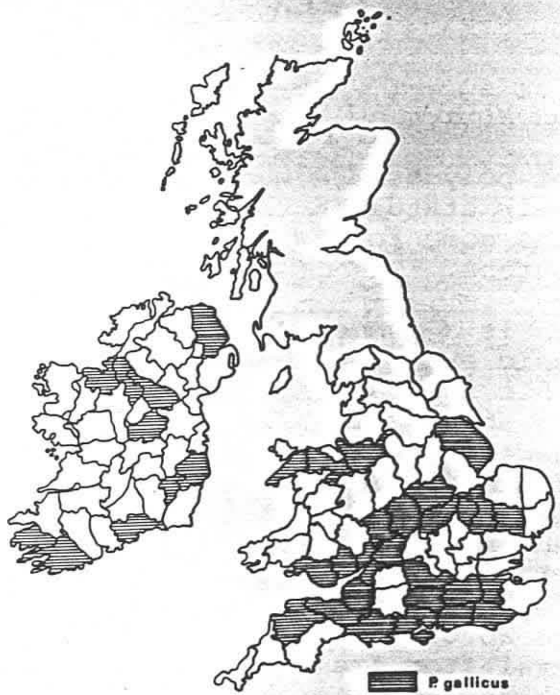

Fig. 7: Distribution of *Polydesmus gallicus* LATZEL in Britain and Ireland.

In marked contrast almost all the British records of *Entothalassinum italicum* are from Kent, and its distribution is markedly south-eastern. It has been found in Monmouthshire (British Myriapod Survey), Essex (BARBER, 1968) and Surrey (KIME, 1968). Though found three times in Guildford in 1967, it has not been seen in Surrey since. Details of the sites are given by BARBER & KIME (in press); most, if not all, were calcareous and near habitation. VERHOEFF (1928) gave details of its range, and it is noteworthy that a species common in the Central Mediterranean region should have a range extended beyond the Alps as far north as Holland and England.

The author believes that *Macrosternodesmus palicola* may be quite common in suitable calcareous localities, having found it on shallow rendzina soils in ten different sites in England, and on no other soil. Seven of these sites were in the survey area, and all were beechwoods growing on chalk. In Kent the species was found, again in a beechwood on chalk. Much further north it was found in chalk scree by a road in the Lincolnshire Wolds, and further north still under rocks and fallen boughs in an ash/sycamore wood on the Magnesian Limestone in County Durham. All the dates of collection fell between 30th December and 19th April, when it was found on or near the soil surface, or at the base of beech litter, sometimes below logs. *M. palicola* is the smallest British millipede, easily overlooked, and it seems probable that it will prove to be widespread where basic sedimentary rocks outcrop over much of England, and there must be very large areas of France and Germany where it might similarly be found, since some of SCHUBART's (1934) localities are certainly calcareous.

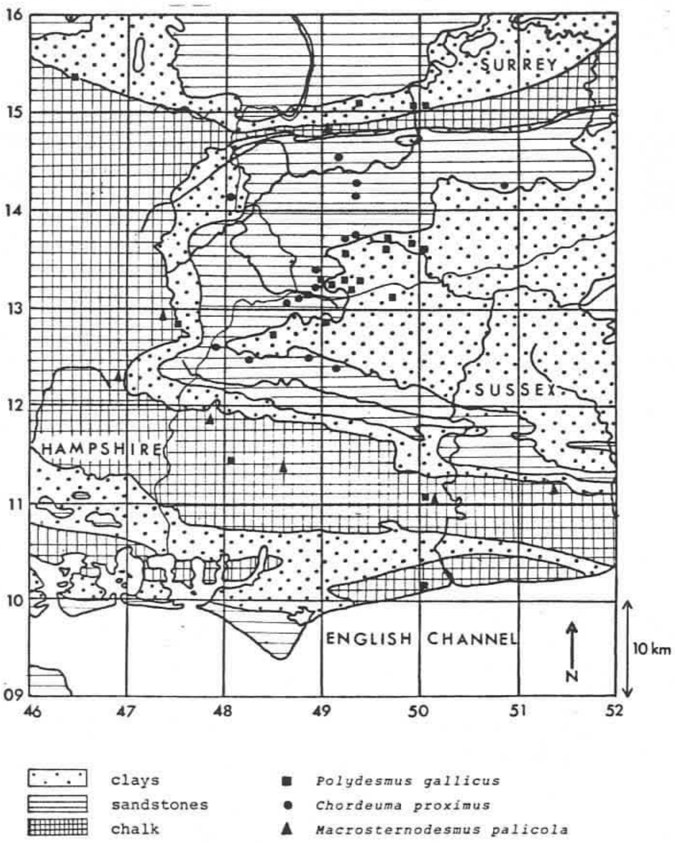

Fig. 8.: Distribution within the survey area of *Polydesmus gallicus*, *Chordeuma proximum* and *Macrosternodesmus palicola*.

Fig. 8 shows the distribution of *M. palicola* in Central Southern England, each site on the chalk outcrop being indicated. The map also shows the points where *C. proximum* and *P. gallicus* were located, the two other species whose distribution appears to be determined by the nature of the soil in this region. All of the *P. gallicus* sites were very moist, except perhaps for a brief period in some summers; those marked on the chalk were in the deep shade of woodland or at the base of escarpments near springs.

Isobates varicornis ranks eighth in the frequency list for Central Southern England as opposed to nineteenth on BLOWER's list for England. This is not considered to be especially significant since the species is widespread in England, and since the amount of woodland in the survey area is well above the National average. The animals were practically all taken from beneath the bark of fallen trees in woods; some were taken from fallen isolated trees in pasture. They occurred on all soil types, and very often on beech trees. Males were very scarce on the trees, usually none being found. No males of the more abundant *Proteroiulus fuscus* (AM STEIN) were noted, although not all the animals were sexed.

The distribution of a number of iulids in the South of England is not typical of their distribution elsewhere in the country. This is extremely noticeable in the case of *Iulus scandinavius*, which has been found in only two one-kilometre squares, out of a total of 198 investigated. In each case only one animal was found, both on Surrey heaths. (It is possible that some immature animals were found; these, and immature stadia of *Ophyiulus pilosus* (NEWPORT) were not determined, apart from some *O. pilosus* found recently, and these always occurred with adults.) There are very few records from Kent (BARBER & KIME, in press), and no records from Sussex, Hampshire, the Isle of Wight and Wiltshire. BLOWER (1969) explained how the even distribution of *I. scandinavius* in the soil and litter of woodland made it appear less common than some other species which could more readily be found aggregated in obvious places, when in reality it was more numerous. No doubt it has been overlooked to some extent, but in view of the enormous amount of collecting that has taken place, and since identical collecting techniques revealed large numbers of this species further north and west, it must be regarded as an uncommon species in the eastern half of Southern England.One was found under a stone on open chalk downland, by a track across the grass, on Walbury Down, Berkshire, 22. IV. 67; going west it has been taken in about half of the Dorset woods visited, and many times in Devonshire. Little work has been done in the New Forest, where it may well extend from Dorset.

There would seem to be an abundance of suitable habitats for *Ommatoiulus sabulosus* in Surrey and West Sussex, details of which are given by BIERNAUX (1969) for Belgium. Yet just two individuals of this very conspicuous species were found, both in May, when they tend to migrate (FAIRHURST, in BLOWER, 1969; BIERNAUX, 1969). As with *I. scandinavius*, there are very few records from Kent (BARBER & KIME, in press) and none from Sussex, Hampshire, the Isle of Wight or Wiltshire. There are records from very county in the South West, beginning in Dorset. It may be significant that BIERNAUX stated that the numbers of *O. sabulosus* had decreased in Belgium since 1963, and that it remained only in certain permanent centres. Perhaps a collection made in 1963 would have been more productive too. At the moment it is hard to find it in the survey area, even in apparently suitable sandy areas.

Cylindroiulus londinensis (LEACH) has not been found in the survey area, but *C. teutonicus* is a common animal in the northern part, having been found in 24 one-kilometre squares in Surrey and 2 one-kilometre squares in Hampshire. Whilst it is common in the most of the South East, there is no record as yet from West Sussex, and it has not been found on the clay belts in the survey area. This animal ranks sixth in Surrey, as opposed to thirteenth in England.

In view of the widespread occurrence of *Cylindroiulus nitidus* (VERHOEFF) on the continent, and of scattered records in England and Scotland, including three in Kent (BARBER & KIME, in press) it may be worth noting that only one specimen came to light in the eight years of this survey, collected from woodland on sandstone by BARBER.

Polyzonium germanicum BRANDT was not found in the survey area, and appears to be confined to the extreme South East.

Table 1 shows that the mean number of species per one-kilometre grid square was 3.1 in Surrey, 3.9 in Sussex, and 4.2 in Hampshire. To a large extent this can be explained by the development of the survey. In Surrey, where the survey began, many often very brief opportunities were seized to look for millipedes, and many one-kilometre squares were treated very superficially. Other squares received much more attention, and as many as 13 or 14 species were listed for the author's home square, one species being on the boundary. *C. punctatus* (LEACH), the most frequently recorded species is listed from 57 % of the Surrey squares; in a very well wooded county this must be a gross underestimate, and all species may well be underrepresented. One or two squares did have a poor fauna when inspected more thoroughly, one very arid square of Tertiary gravel in the London Basin yielded only *Proteroiulus fuscus* during a whole afternoon; this was an area of pine and some birch with much open heather.

Trips into Sussex and Hampshire were usually arranged with a geological map, and each site was usually inspected carefully for at least half an hour, often for much longer. Many of these sites were known to be rich in other types of organisms, and, although many species of millipedes were doubtless still missed, a better average of species per square was obtained.

Sites with ten or more species usually fulfilled one or more of the following conditions:
the soil was calcareous,
the area was woodland, providing a wide range of microhabitats,
old woodland, with a lot of fallen timber was best,
the site had not been significantly altered by man for centuries,
human settlement had made room for synanthropic species.

As the survey developed and spread further afield, more sites of these types were selected for investigation. It happens that West Sussex and Hampshire have extensive calcareous escarpments too steep to develop and covered in old woodland. Hod Hill in Dorset, beechwood and grassland on a chalk escarpment, which according to TANSLEY (1968), has probably remained unploughed since the construction of the Iron Age hill fort there, yielded 11 species. A wooded quarry in the centre of the City of Guildford also yielded

11 species. And also in the North, Castle Eden Dene, Co. Durham, a wooded gorge in limestone running through an otherwise densly populated coastal strip, where surface active species may have gained some benefit from the proximity of the sea.

MELLANBY (1974) refers to the deleterious effect of felling and disturbance of woodland on those species with poor means of dispersal to other perhaps distant woodland sites, and refers to losses of other habitats with mounting agricultural and population pressure. It is likely ~~that~~, while some synanthropic species are increasing their range, that other native species are being more and more subjected to the fragmentation of their range, and that already isolated populations may disappear. This is the main reason why an attempt has been made to concentrate on undisturbed sites in assessing the present distribution of millipedes.

One thing that is clear, and entirely to be expected from the distribution of other groups of organisms about which more is known, is that there are significant changes in the millipede population as one travels east-west through the southern counties of England. A few species, such as *E. italicum* and *P. germanicum*, are confined to the eastern end of the region, while others such as *L. belgicus* are confined to the extreme west. Between these two ends there is a large transition zone, at different points along which more generally distributed species alter in status; most of these, such as *P. polydesmoides*, *P. gallicus*, *O. sabulosus*, *I. scandinavius* and *M. gallicum* become less common or disappear as you go east (the 'Atlantic' species), but *C. londinensis* and *C. teutonicus* do the reverse.

There are some points of difficulty. For instance, *I. scandinavius* is not only more common to the north and west, but also across the Channel on the Continent in the opposite direction. *Leptoiulus belgicus* is found in Belgium (BIERNAUX, 1971), France, the Channel Islands (BARBER & KIME, 1970) and Devon and Cornwall in England, as well as further SE on the Continent. Is lowland NW Belgium more like Devon and Cornwall than like lowland SE England?

The transitional zone for *I. scandinavius* is likely to be in the vicinity of the New Forest in the South of England. Detailed studies in this ancient Forest, where indigenous species are likely to remain, should be of particular significance in the assessment of millipede populations in the South, though not all soils would be represented.

E. Acknowledgements

It is pleasure to acknowledge the help of Mr. J.G. BLOWER in identifying millipedes, and to thank him for making available all ~~t~~his records, and offering encouragement. I am also particularly grateful to Mr. A. D. BARBER who collected a very large number of millipedes in the early years of the survey, complete with details of the habitats in which they were found. I would also like to thank Monsieur J.-P. MAURIES for his help with some of the chordeum~~o~~ids that occur in France.

F. References

BARBER, A.D. (1968): Some Chilopod and Diplopod records from North West Essex. — Ent. mon. Mag., *104*: 268.

BARBER A.D., & KIME, R.D. (1970): Chilopoda and Diplopoda from Guernsey and Herm (Channel Islands). — Ent. mon. Mag., *106*: 223.

BIERNAUX, J. (1969): Biotopes à *Schizophyllum sabulosum* L. — Bull. Rech. agron. Gembloux. N.S., *4*(1).

-- (1971): Atlas Provisoire des Arthropodes Non Insectes de Belgique. Cartes 1 - 24, Myriapodes. — Fac. Sci. Agron. Etat, Zool. Generale Faun. Gembloux.

BLOWER, J.G. (1958): British Millipedes (Diplopoda). — Linn. Soc. Synopses brit. Faun., *11*: 1 - 74. London.

-- (1969): Age-structures of Millipede Populations in Relation to Activity and Dispersion. — Syst. Ass. Publs., *8*: 209 - 216.

-- (1972): The Distribution of British Millipedes as known at the end of 1969. — Bull. brit. Myriapod Grp., *1*: 9 - 38.

-- (1974): The Distribution of British Millipedes as known up to 1970. — Symp. zool. Soc. London, *32*: 603 - 609.

BRÖLEMANN, H.W. (1935): Myriapodes, Diplopodes. — Faune de France, *29*. Paris.

EASON, E.H. (1958): Diplopoda of Warwickshire and Worcestershire. — Annls. Mag. natur. Hist. (13)*1*: 90.

HAACKER, U. (1968): Deskriptive, experimentelle und vergleichende Untersuchungen zur Autökologie rhein-mainischer Diplopoden. — Oecologia, *1*: 87 - 129. Berlin.

KIME, R.D. (1968): A rare Millipede, *Entothalissinum italicum* (LATZEL) in Surrey. — Ent. mon. Mag., *104*: 95.

MELLANBY, K. (1974): The Changing Fauna and Flora of Britain. — Syst. Ass. Spec., *6*: 419 - 423. London (Academic Press).

SCHUBART, O. (1934): Diplopoda. — In DAHL, Die Tierwelt Deutschlands, *82*, Fischer, Jena.

TANSLEY, A.G. (1968): Britain's Green Mantle. — 2nd Edit., revised by M.C.F. PROCTOR. London (George Allen & Unwin, Ltd.).

TURK, F.A. (1944): Myriapoda from Cornwall. — Ann. Mag. natur. Hist. (11)*11*:532.

VERHOEFF, K.W. (1928): Diplopoda I. — In BRONN's Klassen und Ordnungen des Tierreichs, *5*(2): 1 - 1072.

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